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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/648,776	BOSCO ET AL.	
	Examiner	**Art Unit**	
	Mia M. Thomas	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-16_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-16_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _12 August 2003_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _08/12/03_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections - 37 CFR 1.75(a)

1. The following is a quotation of 37 CFR 1.75(a):

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

2. Claims 1,3 and 15 are objected to under 37 CFR 1.75(a) as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery.

Regarding claim 1, the term "said first image" at line 6 lacks an antecedent basis. However, it appears from the context of the claim when read in light of the specification that "said first image" is in fact referring to the "a first video image" first introduced at line 3 of the claim; and this will be assumed for examination purposes. Similarly at claim 3, at line 2 "said second image" lacks an antecedent basis. However, for the same reasons as listed above, it appears that when read in context "said second image" is in fact referring to "a second video image" as recited at line 5 of claim 1.

Regarding claim 3, the term "a further pixel" as claimed at line 2 of the claim, it is unclear to the examiner how exactly to interpret this claimed limitation. It appears that when read in context of the claim when read in light of the specification the claim should read "...processing another pixel of said second image..." and this will be assumed for examination purposes.

Regarding claim 15, the phrase "processing a second, subsequent image" is unclear to the Examiner. Which way should the Examiner interpret this claimed recitation? "A second, subsequent image" is very vague in context of the claim interpretation and appropriate clarification is required for claim interpretation, specifically in light of the specification.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> Nonfunctional descriptive material that does not constitute a statutory process, machine, manufacture or composition of matter and should be rejected under 35 U.S.C. Sec. 101. Certain types of descriptive material, such as music, literature, art, photographs and mere arrangements or compilations of facts or data, without any functional interrelationship is not a process, machine, manufacture or composition of matter. USPTO personnel should be prudent in applying the foregoing guidance. Nonfunctional descriptive material may be claimed in combination with other functional descriptive multi-media material on a computer-readable medium to provide the necessary functional and structural interrelationship to satisfy the requirements of 35 U.S.C. Sec. 101. The presence of the claimed nonfunctional descriptive material is not necessarily determinative of nonstatutory subject matter. For example, a computer that recognizes a particular grouping of musical notes read from memory and upon recognizing that particular sequence, causes another defined series of notes to be played, defines a functional interrelationship among that data and the computing processes performed when utilizing that data, and as such is statutory because it implements a statutory process.

4. Claim 13 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claim 13 recites a "**filter**", which does not impart functionality to a computer or computing device, and is thus considered nonfunctional descriptive material. Such nonfunctional descriptive material, in the absence of a functional interrelationship with a computer, does not constitute a statutory process, machine, manufacture or composition of matter and is thus non-statutory per se. Non-functional descriptive is non-statutory regardless of whether it is claimed as residing on a computer readable medium.

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

5. Claim 14 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claim 14 defines an **"acquisition device" or "acquisition system"** embodying functional descriptive material (i.e., a computer program or computer executable code). However, the claim does not define a "computer-readable medium or computer-readable memory" and is thus non-statutory for that reason (i.e., "When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized" – Guidelines Annex IV). The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests amending the claim(s) to embody the program on "computer-readable medium" or equivalent; assuming the specification does NOT define the computer readable medium as a "signal", "carrier wave", or "transmission medium" which are deemed non-statutory (refer to "note" below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

"A transitory, propagating signal ... is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (<u>In re Nuijten, 84 USPQ2d 1495 (Fed. Cir. 2007)</u>. Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would be non-statutory. Should the applicant's specification

define or exemplify the computer readable medium or memory (or whatever language applicant chooses to recite a computer readable medium equivalent) as statutory tangible products such as a hard drive, ROM, RAM, etc, **<u>as well as</u>** a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests amending the claim to *<u>include</u>* the disclosed tangible computer readable storage media, while at the same time *<u>excluding</u>* the intangible transitory media such as signals, carrier waves, etc.

Merely reciting functional descriptive material as residing on a tangible medium is not sufficient. If the scope of the claimed medium covers media other than "computer readable" media (e.g., "a tangible media", a "machine-readable media", etc.), the claim remains non-statutory. The full scope of the claimed media (regardless of what words applicant chooses) should not fall outside that of a computer readable medium.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Acharya (US 6,091,851).

Regarding Claim 1: Kalevo teaches a method for filtering the noise of a sequence of digital images in video format ("In this paper, some arrangements to apply Noise Reduction (NR) techniques for images captured by a single sensor digital camera are studied. Usually, the NR filter processes full three color component image data." @ abstract; further, "The 'Tiger' image is from the image gallery of Adobe© Photoshop© 6.0 CD. The original image is cropped to Video Graphics Array (VGA)-resolution (640x80) for our testing purpose." at page 348, Section I paragraph 5) comprising the following phases:

processing a first video image of the sequence to obtain a corresponding improved video image with reduced noise (Refer to page 349, Section 2, paragraph 3, "Three possible basic image processing chains, including Noise Reduction (NR) and the CFAI are illustrated in Figure 2"; further at page 350, paragraph 3, "The better quality interpolator is used, the better also the improvements in the denoising algorithms can be seen on the final interpolated output image.");

carrying out a digital filtering of a first type using pixels forming part of said first and second set to generate the filtered pixel (Refer to page 353, Section 2.4 "Noise Elimination Capability and Image Smoothing"; "The filtered images were compared to the original image and MAE and MSE were calculated.").

Acharya teaches processing at least one pixel of a second video image of the sequence that temporally follows said first image ("Processing of steps 110-160 will repeat for every pixel until all pixels in the raw image have been assigned R, G, and B values. In the case of an 8-bit Bayer pattern CFA, each newly formed full color pixel may have a total resolution of 24 bits.

Thus, according to step 170, this methodology checks if any more raw image pixels are remaining that have missing color components to be interpolated. If there are no more pixels that have missing color components (checked at step 170), then the interpolation process will have been completed for a given image." at column 5, line 44),

selecting a first set of pixels comprising said at least one pixel and a plurality of pixels of the second video image spatially adjacent to it (Refer to Figure 1, numeral 120; "Essentially, the pixel surrounding the block of pixels with the "closest" color median to the color median of the block of pixels surrounding the raw image pixel for which the missing component is being interpolated is chosen to be that missing component." at column 3, line 45-49; further at column 3, line 50-column 4, line 12);

selecting a second set of pixels comprising pixels of the improved video image homologous with the pixels of said first set (Refer to Figure 1, numeral 170, "Yes" direction", specifically at column 4, line 13+)

Kalevo and Acharya are combinable because they are in the same field of color image processing, specifically noise reduction in Bayer matrix images. (See title, classification of each invention).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to select a first set of pixels comprising said at least one pixel and a plurality of pixels of the second video image spatially adjacent to it; selecting a second set of pixels comprising pixels of the improved video image homologous with the pixels of said first set and also

processing at least one pixel of a second video image of the sequence that temporally follows said first image.

The suggestion/motivation for doing so would have been to obtain " a new pixel that has full color information which is a function of the raw image pixel and the interpolated color components." (also see column 2, line 40, Acharya)

Therefore it would have been obvious to the skilled artisan to combine the teachings of Kalevo and Acharya to obtain the specified claimed elements of Claim 1.

Regarding Claim 13 (*As best understood by the Examiner*): Kalevo teaches a filter for reducing the noise of a sequence of images in CFA format, characterized in that said noise reduction is obtained by means of a method in accordance with claim 1 ("This requires that raw Bayer-matrix image data, available from the image sensor, is first interpolated by using Color Filter Array Interpolation (CFAI) method." at page 348, abstract).

Regarding Claim 14 (*As best understood by the Examiner*): Kalevo teaches an acquisition device for acquiring a sequence of digital images in CFA format, comprising a sensor for acquiring said images, said sensor comprising a CFA filter, characterized in that the sequence of images in CFA format is processed by means of a noise filtering method in accordance with claim 1 ("The fourth image processing chain, not shown in Figure 2, is to apply the NR method twice. For example, first some pre-CFAI NR method is used in the imaging device and then some post-CFAI NR method is applied in another some powerful device (e.g. in personal computer (PC))". at page 350, paragraph 2).

8. Claims 2-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Acharya (US 6,091,851) and further in view of Gindele et al. (US 2003-0095717 A1).

Regarding Claim 2:

Kalevo and Acharya in combination teach/disclose all the claimed elements as rejected above. Kalevo and Acharya in combination does not specifically (expressly) disclose an evaluation of motion of the at least one pixel, using pixels forming part of said first and second set and in which said at least one pixel is such that said evaluation of motion is smaller than a first threshold value. However,

Gindele teaches a phase of: carrying out a first evaluation of motion of the at least one pixel, using pixels forming part of said first and second set ("Using this assumption, one evaluates the standard deviation of the noise for a number of typical mean pixel values and sets the noise threshold value equal to 2 times the standard deviation." at paragraph [0026]);
and in which said at least one pixel is such that said evaluation of motion is smaller than a first threshold value ("If, in block 46, this green pixel value difference is less than or equal to the noise threshold value, then the green pixel value is included in the subsequent noise cleaning calculation shown in block 48." at paragraph [0026]).

Kalevo, Acharya and Gindele are combinable because they are in the same field of image enhancement, specifically image filtering.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to perform an evaluation of motion of the at least one pixel, using pixels forming part of said first and second set and in which said at least one pixel is such that said evaluation of motion is smaller than a first threshold value.

The suggestion/motivation for doing so would have been to perform a noise calculation as described at paragraph [0026] and Figure 7. Specifically, "If the green pixel value difference exceeds the noise threshold, then the green pixel value is not used in the subsequent noise cleaning calculation in block 50. Once each green pixel value in the kernel is tested, then a noise cleaned value for the central green pixel value is calculated in block 52. This calculation in this embodiment is a simple average of all of the green pixel values that satisfied the noise threshold value comparison accomplished in block 48.", Gindele)
The overall purpose of the "noise cleaning" is to process the digital color images to provide a noise clean sparsely populated color digital image" at abstract, Gindele.

Therefore, it would obvious to one of ordinary skill in the art to combine the teachings of Kalevo, Acharya and Gindele to obtain the specified claimed elements of Claim 2.

Regarding Claim 3: Kalevo teaches processing a further pixel of said second image (Refer to page 348, Section I, Introduction, paragraph 2): said phase of processing the further pixel providing a corresponding further filtered pixel and including the following operations

selecting a third set of pixels comprising said further pixel and a plurality of pixels of the second video image spatially adjacent to it (Refer to page 353, Section 2.5 "Solutions for Pre-CFAI Noise Reduction Filtering", paragraph 1; also Refer to Figure 6);

selecting a fourth set of pixels comprising pixels of the improved video image homologous with the pixels of said third set (Refer to page 353, Section 2.5 "Solutions for Pre-CFAI Noise Reduction Filtering", paragraph 1; also Refer to Figure 6);

carrying out a further evaluation of motion of the further pixel, using pixels forming part of said third and fourth set (Refer to table 3 and 4; Section 2.4 "Noise Elimination Capability and Image Smoothing", paragraphs 1 and 2);

whenever said further evaluation of motion is smaller than said first threshold value, carrying out a digital filtering of a second type that generates the further filtered pixel by using exclusively pixels forming part of said third set (Refer to page 354, paragraph 1, specifically, "If at least the other difference is bigger than the predefined threshold an edge is detected. When the edge is detected, the change from the original pixel value to the filtered result is limited by limit.").

Regarding Claim 4: Kalevo teaches each video image of the sequence is made up of a respective pixel matrix, the pixels of said matrix being associated on the basis of their respective positions with one of a set of chromatic components ("This required that raw Bayer-matrix image data, available from the image sensor, is first interpolated by using Color Filter Array Interpolation (CFAI) method." at page 348, abstract), and wherein said first and second set comprise pixels associated with the same chromatic component of the at least one pixel (By way of example, refer to page 349, Section 2, paragraph 3, "Now, the amount of pixels in the NR is three times the number of pixels in the image, the third (c) image processing chain, in Figure 2, shows the post CFAI-NR arrangement, which is done in the YUV color space. Usually,

only the luminance component (Y) is filtered here, because it is the most important component for the Human Visual System (HVS)[7].", further at page 350, paragraphs 1 and below.).

Regarding Claim 5: Kalevo teaches the images of the sequence are in Bayer CFA format and said chromatic components form part of the set comprising the color red, the color green and the color blue ("The CFA, which is usually used, is called as Bayer-matrix. It consists of read, green and blue color filter elements arranged so, that each sensor element, also called as picture element (pixel) collects only one colored light." at page 349, Section 2, Image Processing Chain).

Regarding Claim 6: Kalevo teaches the phase of selecting the first set of pixels is carried out by means of selection matrices that differ according to the chromatic component of the at least one pixel ("When the post CFAI-NR image processing chains is used the image consists on all the three color component values for each pixel, when the NR is applied. When the pre-CFAI NR chain is used the image consists on only one-color component value for ach pixel, when the NR is processed. Any of the 4-neighbor pixels does not consist of the same color component value as the center pixel.),

the selection matrices being such as to select pixels that are situated in the neighborhood of the at least one pixel and having the same chromatic component as said at least one pixel ("Usually, the NR filter processes full three-color component image data. This requires that raw Bayer-Matrix image data, available from the image sensor, is first interpolated by using Color Filter Array Interpolation (CFAI) method." at abstract),

discarding the others ("Removing the other color components from the original three color components from the original three color component image data the one color component image data has been generated." at page 348, Section I, Introduction, paragraph 6);

the selection matrices being also identical for the chromatic components red and blue (Figure 3, (d-f), specifically, (c) and (f)).

9. Claims 7-10, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Acharya (US 6,091,851) and further in view of Heimburger et al. (5,490,094).

Regarding Claim 7:

Kalevo and Acharya in combination teach/disclose all the claimed elements as rejected above. Kalevo and Acharya in combination does not specifically (expressly) disclose a phase of making an estimate a statistical parameter [(sigma) $_n{}^{GL}$] representative of the global noise present in said first image (Img_{n-1}), the digital filtering of the first type utilizing also said statistical parameter.

However, Heimburger teaches a phase of making an estimate a statistical parameter [(sigma) $_n{}^{GL}$] representative of the global noise present in said first image (Img_{n-1}), the digital filtering of the first type utilizing also said statistical parameter (Refer to column 3, lines 12-28) Additionally, Heimburger does not explicitly teach/disclose that the noise removal is a digital filtering in the specification, however at claim 1, line 1, at column 7, line 66, Heimburger specifically

discloses/teaches "a method for noise reduction of a digital video input signal comprising the steps of filtering said digital video input...". This recitation is to further support the claimed limitation of "digital filtering". Further see column 3, line 66; "The global noise statistics can be calculated in a noise measurement circuit 20.

Kalevo, Acharya and Heimburger are combinable because they are in the same field of image enhancement, specifically image filtering for noise reduction.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to estimate a statistical parameter [(sigma) $_n{}^{GL}$] representative of the global noise present in said first image (Img_{n-1}), the digital filtering of the first type utilizing also said statistical parameter.

The suggestion/motivation for doing so would have been to accurately estimate "the size of the noise estimation window. Further the noise estimation window can be different from the size of the window used by the restoration filter, wherefore they can be adjusted independently for optimal performance." at column 3, line 25, Heimburger.

Therefore, it would obvious to one of ordinary skill in the art to combine the teachings of Kalevo, Acharya and Heimburger to obtain the specified claimed elements of Claim 7.

Regarding Claim 8: Heimburger teaches selecting a plurality of pixels of the first image (Refer to Figure 3; also column 4, lines 26-48); calculating a plurality of local estimates ("A noisy input signal x is filtered with a restoration filter of median type to generate a filtered input signal y. The sum of the absolute differences between filtered and unfiltered signal is calculated for each

position of a sliding window within the input signal representing a local estimate of the noise..." at abstract), calculating for each given pixel of said plurality of pixels a respective estimate of a statistical parameter representative of the local noise in present in a neighborhood of the given pixel ("This method allows switching between filters depending on the statistical properties of the local filtered and unfiltered pictures." at column 4, lines 19-26); and wherein said estimate of the statistical global noise parameter [(sigma) $_{n}$ ^{GL}] is obtained from said plurality of local estimates ("...filtering said digital video input signal by applying said digital video input signal in parallel to at least three circuit branches, a first of said circuit branches containing no filter, the remaining branches containing respective filters of differing filter types; estimating for each said circuit branch within a sliding window in a current picture of said digital video input signal a local noise value from the quadratic error between the filter output signals of each two consecutive branches by calculating pixel difference signals within said window; forming for each branch a weighted average of the two signals used in each of said two consecutive branches for estimating said quadratic error, thereby taking into account for the weight a global noise value and the local noise value for the branch..." at column 8, line 1).

Regarding Claim 9: Heimburger teaches local estimates are local variance measures ("The sum of the absolute differences between filtered and unfiltered signal is calculated for each position of a sliding window within the input signal representing a local estimate of the noise..." at abstract; "The present invention applies to noise reduction systems of a type in which, for estimating a local noise value within a sliding window of a picture..." at column 1, line 23, further at column 3, line 21).

Regarding Claim 10: Heimburger teaches said plurality of pixels comprises pixels forming part of homogeneous regions of the first image ("The sliding window 30 depicted in FIG. 3 has a size of 5 pixels by 3 lines. As the processing is not on a frame basis but on a field (F1; F2) basis, this size corresponds to a region of 5 by 5 pixels for the interlaced picture (lines of filed F1)." at column 4, line 28, further; "The present invention, however, provides a technique of noise reduction that is both globally and locally adaptive. In other words, noise reduction in the systems described herein adapts both to large features and to fine detail of displayed images." at column 3, line 9).

Regarding Claim 12: Heimburger teaches a phase of estimating for the further pixel a further statistical parameter representative of the noise present on the pixels of said third set (Refer to column 3, lines 29-38), said further parameter estimated also on the basis of the specific color of the further pixel, the digital filtering of the second type utilizing said further parameter ("...estimating for each said circuit branch within a sliding window in a current picture of said digital video input signal a local noise value from the quadratic error between the filter output signals of each two consecutive branches by calculating pixel difference signals within said window..." at column 8, line 6-11).

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Acharya (US 6,091,851). and further in view of Heckman (US 2002/0164063 A1).

Regarding Claim 11:

Kalevo and Acharya in combination teach/disclose all the claimed elements as rejected above. Kalevo and Acharya in combination does not specifically (expressly) disclose/teach a further selection phase carried out in accordance with a Duncan Range Test.

However, Heckman teaches said digital filtering of the first type utilizes a subset of pixels forming part of said first and said second set of pixels, said subset being identified by means of a further selection phase carried out in accordance with a Duncan Range Test (Refer to paragraph [0138] and [0140]).

Kalevo, Acharya and Heckman are combinable because they are in the same field of image enhancement, specifically classification of images.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to utilize a classification method of selecting pixels of interest using the Duncan Range Test.

The suggestion/motivation for doing so would have been to utilize a classification method of selecting pixels of interest using the Duncan Range Test because "the statistical significance of differences among sample means within each experiment was determined by the Duncan multiple range test. To determine whether any factor's values differed among treatment groups within an experiment, the GLM and MODEL discriminant analysis procedures of SAS were used." (paragraph [0140], Heckman).

Therefore, it would obvious to one of ordinary skill in the art to combine the teachings of Kalevo, Acharya and Heckman to obtain the specified claimed elements of Claim 11.

11. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Garakani et al. (US 6,240,208 B1).

Regarding Claim (As best understood by the Examiner) 15: Kalevo teaches a method for filtering noise from a digital video image ("In this paper, some arrangements to apply Noise Reduction (NR) techniques for images captured by a single sensor digital camera are studied. Usually, the NR filter processes full three color component image data." @ abstract; further, "The 'Tiger' image is from the image gallery of Adobe© Photoshop© 6.0 CD. The original image is cropped to Video Graphics Array (VGA)-resolution (640x80) for our testing purpose." at page 348, Section I paragraph 5)

processing a first image to generate an improved image (Refer to page 349, Section 2, paragraph 3, "Three possible basic image processing chains, including Noise Reduction (NR) and the CFAI are illustrated in Figure 2"; further at page 350, paragraph 3, "The better quality interpolator is used, the better also the improvements in the denoising algorithms can be seen on the final interpolated output image.");

processing a second, subsequent image ("In this paper, some arrangements to apply Noise Reduction (NR) techniques for images captured by a single sensor digital camera are studied." at abstract; "The first image, with exposure time almost zero, provides the initial charging state of the sensor elements. Subtracting the first image from the second image, taken with normal

exposure control, the fixed pattern noise can be reduced." at page 348, Section I. "Introduction", paragraph 2);

selecting a first pixel from the second image during the processing of the second image (Refer to page 349, paragraph 2, specifically; "where (i(x,y) is the original pixel value and <i(x,y) is the corresponding pixel value of the processed image. The size of the image is m x n.");

selecting a first set of pixels in the second image that are a predetermined spatial relationship to the first pixel ("It operates by detecting edges in the 4-neighbors of the current pixel." at page 353, Section 2.5 "Solutions for Pre-CFAI Noise Reduction Filtering", paragraph 1);

locating a corresponding second set of pixels in the first image that correspond to the first set of pixels in the second image (Refer to page 349, paragraph 2, specifically; "where (i(x,y) is the original pixel value and <i(x,y) is the corresponding pixel value of the processed image. The size of the image is m x n.");

Kalevo does not specifically (expressly) teach filtering the first pixel using data from both the first set and the second set of pixels.

Garakani teaches filtering the first pixel using data from both the first set and the second set of pixels ("The method then uses a series of measurable parameters to filter possible reference sites in the image and produces and ordered set of possible reference sites." at abstract;).

Kalevo and Garakani are combinable because they are in the same field of feature extraction and image filtering.

At the time that the invention was made, it would have been obvious to the skilled artisan at the time of the invention to filtering the first pixel using data from both the first set and the second set of pixels.

The suggestion/motivation for doing so would have been "to use multi-resolution images to enhance efficiency of the identification and that specifically measures the symmetry, orthogonality and uniqueness of the windows (images)." (at abstract, Garakani)

Therefore, it would have been obvious to the skilled artisan to combine the teachings of Kalevo and Garakani to obtain the specified claimed elements of Claim 15.

12. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kalevo et al. "Noise Reduction Techniques for Bayer-Matrix Images"; Sensors and Camera Systems for Scientific, Industrial and Digital Photography, pages 348-359 in combination with Garakani et al. (US 6,240,208 B1).and further in view of Astle (US 5,751,861).

Regarding Claim 16:

Kalevo and Garakani in combination teach/disclose all the claimed elements as rejected above. Kalevo and Garakani in combination does not specifically (expressly) teach determining a motion component between the first set of pixels and the second set of pixels and carrying out a motion compensator filtering based on a selected threshold value. However,

Astle teaches performing spatial filtering on the first pixel (Refer to column 3, line 27 also abstract);

determining a motion component between the first set of pixels and the second set of pixels (Refer to numerals 310 and 320; "This allows selective filtering to be applied solely to potentially artifactual or problematic areas of the block in integer pixel motion-compensation schemes, without wasting extra processing time filtering other regions of the block, and without filtering out useful information such as high-frequency details in other portions of the block." at column 6, line 48);

and carrying out a motion compensator filtering if the first motion component between the first set and the second set is above a selected threshold and not carrying out motion compensation filtering if the motion component between the first set and the second set is below a selected threshold ("As will be understood, the amount of high-frequency detail in a block may be quantified and if below a certain threshold, the filtering along embedded block edges 310, 320 will proceed." at column 7,line 1).

Kalevo, Garakani and Astle are combinable because they are in the same field of image enhancement and restoration.

At the time that the invention was made, it would have been obvious to the skilled artisan to determine a motion component between the first set of pixels and the second set of pixels and carrying out a motion compensator filtering based on a selected threshold value.

The suggestion/motivation for doing so would have been "to decrease the artifacts that arise due to inaccuracies in the encoding process." (See column 2, line 45, Astle).

Therefore, it would have been obvious to the skilled artisan to combine the teachings of Kalevo, Garakani and Astle to obtain the specified claimed elements of Claim 16.

Priority

13. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 7352909	US 5065444	US 6496605	US 7260272
US 5805216	US 2005/0248671		

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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